

07-24-00

A

Practitioner's Docket No. 528-008605-US (PAR)

PATENT

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: *All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.' * M.P.E.P. § 601, 7th ed.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): Steve T. Barham, Samuel Kingston, Randal R. Sylvester,
Ronald Leahy.

WARNING: 37 C.F.R. § 1.41(a)(1) points out:

"(a) A patent is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(f) is filed supplying or changing the name or names of the inventor or inventors."

For (title):

APPARATUS FOR RAPID PN CODE ACQUISITION

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory)
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 7/21/00, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL627420348US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Debra Conrad
(Type or print name of person mailing paper)

Debra Conrad
Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

*WARNING: Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).
"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

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07/21/00
10887 U.S. PRO

07/21/00
988029/60
PTO
S U O87C7C

1. Type of Application

This new application is for a(n)

(check one applicable item below)

- ☒ Original (nonprovisional)
☐ Design
☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

- ☐ Divisional.
☐ Continuation.
☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

- (i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or
(ii) Complete as set forth in § 1.51(b); or
(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(c) and include the basic filing fee set forth in § 1.16; or
(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(f) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

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WARNING: When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

- ☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

7 Pages of specification

5 Pages of claims

5 Sheets of drawing

WARNING: DO NOT submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).
- ☐ formal
- ☐ informal

B. Other Papers Enclosed

8 Pages of declaration and power of attorney

1 Pages of abstract

Other

4. Additional papers enclosed

- ☐ Amendment to claims
- ☐ Cancel in this applications claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
- ☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)
- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. § 1.98)
- ☒ Form PTO-1449 (PTO/SB/08A and 08B)
- ☒ Citations

- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(e)(1)-(4).

NOTE: "The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.62, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(f) is filed supplying or changing the name or names of the inventor or inventors." 37 C.F.R. § 1.41(e)(1).

☒ Enclosed

Executed by

(check all applicable boxes)

☒ Inventor(s).

☐ legal representative of inventor(s).
37 C.F.R. §§ 1.42 or 1.43.

☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. See item 13 below for fee.

☐ Not Enclosed.

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

- ☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

- ☒ The same.

or

- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,
☐ is submitted.
☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

- ☒ English
☐ Non-English
☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

- ☒ An assignment of the invention to L-3 Communications Corporation

- ☒ is attached. A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.
☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

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9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Country	Appln. No.	Filed
Country	Appln. No.	Filed

from which priority is claimed

- ☐ is (are) attached.
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. § 1.16)A. ☒ Regular application

CLAIMS AS FILED			
Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) \$690.00
Total			
Claims (37 C.F.R. § 1.16(c))	17 - 20 = 0	×	\$ 18.00
Independent			
Claims (37 C.F.R. § 1.16(b))	3 - 3 = 0	×	\$ 78.00
Multiple dependent claim(s),			
if any (37 C.F.R. § 1.16(d))		+	\$260.00

- ☐ Amendment cancelling extra claims is enclosed.
☐ Amendment deleting multiple-dependencies is enclosed.
☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(c).

Filing Fee Calculation \$ 690.00

B. ☐ Design application
 (\$310.00—37 C.F.R. § 1.16(f))

Filing Fee Calculation \$ _____

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- C. ☐ Plant application
(\$480.00—37 C.F.R. § 1.16(g))

Filing fee calculation

\$ _____

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

WARNING: "Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).

WARNING: "Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application

_____ / _____, filed on _____, from which benefit is being claimed for this application under:

- 35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ _____

NOTE: Any excess of the full fee paid will be refunded if small entity status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ Filing fee \$ 690.00

☒ Recording assignment
(\$40.00; 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR
ASSIGNMENT ACCOMPANYING NEW
APPLICATION".) \$ 40.00

☐ Petition fee for filing by other than all the
inventors or person on behalf of the inventor
where inventor refused to sign or cannot be
reached
(\$130.00; 37 C.F.R. §§ 1.47 and 1.17(l)) \$ _____

☐ For processing an application with a
specification in
a non-English language
(\$130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) \$ _____

☐ Processing and retention fee
(\$130.00; 37 C.F.R. §§ 1.53(d) and 1.21(l)) \$ _____

☐ Fee for international-type search report
(\$40.00; 37 C.F.R. § 1.21(e)) \$ _____

NOTE: 37 C.F.R. § 1.21(f) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(b)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(f) must be paid, within 1 year from notification under § 53(f).

Total fees enclosed \$ 730.00

14. Method of Payment of Fees

☒ Check in the amount of \$ 730.00

☐ Charge Account No. _____ In the amount of
\$ _____

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 16-1350;

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

☒ 37 C.F.R. § 1.17 (application processing fees)

NOTE: "... A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . ." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(e).

- ☒ Credit Account No. 16-1350
☐ Refund

Reg. No. 31,686

Tel. No. (203) 259-1800

Customer No. 2512

Mark F. Harrington
SIGNATURE OF PRACTITIONER

Mark. F. Harrington
(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address
425 Post Road
Fairfield, CT 06430

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

- ☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

- ☒ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added 4

☐ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

- ☐ This transmittal ends with this page.

528-008605-US (PAR)

SL-005

Patent Application Papers Of:

Steven T. Barham

Samuel Kingston

Randal R. Sylvester

Ronald Leahy

For: Apparatus for Rapid PN Code Acquisition

APPARATUS FOR RAPID PN CODE ACQUISITION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to communications and, more particularly, to code division multiple access techniques.

2. Prior Art

Referring now to Fig. 2 there is shown a block diagram of a direct sequence coded spread spectrum system. As shown in the diagram a carrier signal generated by carrier generator 80 is modulated at mixer 98 by data 82. The data modulation operates at a rate determined by code clock divided by spreading gain G 84. The modulated signal is further mixed 99 with a code generated by the pseudo-noise (PN) code generator 86 operating at a clock rate determined by code clock 85. The transmitter 88 transmits the twice modulated signal via antenna 90. The transmitted signal is received by receiver 94 via antenna 92. The received signal is correlated with a PN code generated by PN code generator 106 at mixer 96. A signal passing correlation is then demodulated by mixing the correlated signal with a local carrier recovery 104 in mixer 100. The transmitted data and clock rate are recovered in data processing 102 and 108, respectively. The recovered data 110 is passed to the remainder of the system for further processing while the recovered clock is used to drive the PN code generator 106 and the data processing 102 after being reduced by spreading gain G 112. The spreading gain is determined by the PN code rate R_c divided by the message rate R_b . The time duration of

Rc is $1/Rc = T_c$ and is referred to as a chip. In general, when changing from a low-rate PN code to a higher rate PN code, where $T_{c_{low}}$ and $T_{c_{high}}$ are the chip times, respectively, the spreading gain is multiplied by the ratio $T_{c_{low}} / T_{c_{high}}$. The average time that is required to complete a search for PN timing is k/R_b per chip of uncertainty, where k is some constant of proportionality based on the search technique. Hence, if we do the initial search using a shorter low-rate PN and then synchronously switch to a higher-rate PN the average search time can be reduced by as much as $T_{c_{low}} / T_{c_{high}}$.

SUMMARY OF THE INVENTION

In accordance with one method of the present invention, a method for determining a signal code. The method comprising steps of acquiring and correlating a signal with a first code sequence and achieving a timing lock in response to the step of correlating the signal with a first code sequence. Also in response to the correlated signal the receiver transmits an acknowledgement signal to a transmitter of the signal where upon the receiver and transmitter change from the first code sequence to a second code sequence.

In accordance with one embodiment of the present invention a signal code acquisition system comprising a first transceiver and a first multi-rate code generator connected to the first transceiver; a second transceiver responsive to the first transceiver; and a second multi-rate code generator connected to the second transceiver.

In accordance with another method of the present invention a method of determining a coded signal, the method comprising steps of: transmitting a first coded signal from a transmitter system; receiving the first coded signal on a receiver system; calculating a probability of detection of the first coded signal; and changing the first coded signal to a second coded signal responsive to the probability of detection (PD) of the first coded signal.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and other features of the present invention are explained in the following description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a satellite communications system and a base station communications system to which the satellite communications system is bidirectionally coupled through a wireless RF link and incorporates features of this invention;

Fig. 2 is a block diagram of a direct sequence PN coded system;

Fig. 3 is a block diagram of multi-rate PN coded system illustrating an embodiment of this invention;

Fig. 4 is a flow chart illustrating one method of the present invention; and

Fig. 5 is a flow chart illustrating an alternative method of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Although the present invention will be described with
5 reference to the embodiments shown in the drawings, it
should be understood that the present invention can be
embodied in many alternate forms of embodiments. In
addition, any suitable size, shape or type of elements or
materials could be used.

10 Reference is first made to Figs. 1 for illustrating a
base station 10, such as but not limited to satellite
communications base station, that is suitable for
practicing this invention. The base station 10 includes
an antenna 12 for transmitting signals to and for
15 receiving signals from a base orbiting satellite 30.

Referring now to Figs. 1 and 3. The base station 10 and
the orbiting satellite 30 include circuitry for
transmitting coded signals 51 and circuitry for decoding
received signals 61. The circuitry for transmitting coded
20 signals includes a multi-rate pseudo-noise (PN) code
generator 52, transmitting timing and control circuitry
50, a transmitter 54, data source 56, and an antenna 58.
The circuitry for receiving the coded signal includes a
receiver front end 62, a synchronization detector 68,
25 receiving timing and control circuitry 66, a multi-rate
PN code generator 64, data estimator 70, and an antenna
60 for receiving signals. The coding method for this
invention is assumed to be based on CDMA such as is known
from or that is similar to air standards IS-95 PCS or W-

CDMA, although the teaching of this invention is not intended to be limited only to that particular type of CDMA system. The present invention, providing significant reduction in PN code acquisition time over conventional
5 PN code acquisition time, could be used with any suitable type of radio telephone system or suitable electronic device

Referring now to Figs. 3 and 4, there is shown a block diagram of a transmitter and receiver system and a method
10 flow chart incorporating features of the present invention. The transmitter 54 transmits data 56 modulated by a carrier signal and further modulated by multi-rate PN code generator 52 through antenna 58. The PN code generator 52 is controlled by timing and control
15 circuitry 50. The receiver 62 receives the twice modulated carrier signal 120 via antenna 60. The signal is auto-correlated with a PN code 122 supplied by multi-rate PN code generator 64. If the signal auto-correlation peak is found then the signal is a desired signal and is
20 further demodulated to retrieve data 126 and recover synchronization 68. The synchronization then tracks the PN timing 128 via the timing and control circuitry 66 and signals the transmitting system and the receiving system to contemporaneously shift to a higher rate PN code 132
25 via their respective multi-rate PN generators 52, 64. Thus, for purposes of illustration, if the lower rate PN code duration is designated as TC_{low} and the higher rate PN code duration is designated as TC_{high} the search time, or PN code acquisition time, is reduced by a factor of
30 TC_{low}/TC_{high} . For example, in the prior art the search time for a PN code duration is the processing gain times an uncertainty factor. Using the lower code duration TC_{low} ,

the processing gain is $T_b / T_{C_{low}}$, where T_b is the message bit duration. Without the current invention the processing gain when shifting to a higher rate PN code would be $T_b / T_{C_{high}}$. Assuming that $T_{C_{high}}$ is some multiple
 5 $1/M$ of $T_{C_{low}}$ then the processing gain equation can be rewritten as $T_b * M / T_{C_{low}}$. Then, assuming an average search rate of k/R_b per chip of uncertainty, the PN search time is then $(M * T_b / T_{C_{low}}) * k/R_b$, where R_b is the message bit rate. Thus, the average search time has been increased by
 10 a factor of M when shifting from a low rate PN code to a high rate PN code. By contrast, the current invention uses a narrow bandwidth timing recovery loop to maintain the timing lock achieved during the acquisition of the first or lower rate PN code while both multi-rate
 15 generators contemporaneously shift to the higher rate PN code. Since the timing lock is maintained the search time equation is the original gain times the uncertainty factor, which in this example is $T_b / T_{C_{low}} * (k/R_b)$. Thus, the average search rate has been reduced by a factor M
 20 when shifting from the lower rate PN code to the higher rate PN code.

Referring now to Fig. 5 there is shown a flow chart of a second method of the present invention. The transmitter transmits 140 a low rate PN modulated signal. The
 25 transmitter calculates a probability of detection (PD) 142 by the receiver 62. If the PD is greater than a predetermined amount 144 the transmitter will shift 146 the multi-rate PN generator 52 to a higher rate PN code after a predetermined amount of time or event. Meanwhile,
 30 the receiver 62 receives 160 the signal and auto-correlates 158 with the low rate PN code generated by the multi-rate PN generator 64. If the signal auto-

correlation peak is found 156 then the data is decoded 154 and the synchronization detector 68 and the timing and control circuitry lock 152 on to the signal timing . The receiver also calculates the PD and if greater than 5 the predetermined amount will shift 150 the multi-rate PN generator 64 to the higher PN code 148 after the predetermined amount of time or event. The processing gain and search times are calculated as before.

10 It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances which fall 15 within the scope of the appended claims.

CLAIMS

1. A method of determining a signal code, the method comprising steps of:

acquiring a signal;

correlating the signal with a first code sequence;

achieving a timing lock in response to the step of correlating the signal with a first code sequence;

transmitting, in response to the step of correlating the signal with a first code sequence, an acknowledgement from a receiver of the signal to a transmitter of the signal ; and

changing, in response to the step of correlating the signal with the first code sequence, to a second code sequence.

2. A method as in claim 1 wherein the step of correlating the signal with the first code sequence comprises the step of correlating the signal with a first pseudo-noise (PN) code sequence.

3. A method as in claim 2 wherein the step of changing to the second code sequence comprises the step of changing to a second PN code sequence.

4. A method as in claim 1 wherein the step of changing to the second code sequence comprises the steps of:

tracking the first code sequence in the receiver of the signal;

changing the first code sequence of a first code generator of the transmitter of the signal to the second code sequence; and

changing the first code sequence of a second code generator of the receiver of the signal to the second code sequence.

5. A method as in claim 4 wherein the steps of changing the first code sequence to the second code sequence in the transmitter and receiver, respectively, comprise the steps of changing from the first code sequence to the second code sequence in the transmitter and receiver, respectively, on the occurrence of a predetermined event.

6. A signal code acquisition system comprising:

a first transceiver;

a first multi-rate code generator connected to the first transceiver;

a second transceiver responsive to the first transceiver; and

a second multi-rate code generator connected to the second transceiver.

7. A signal code acquisition system as in claim 6 wherein the first multi-rate code generator comprises a pseudo-noise (PN) code generator.

8. A signal code acquisition system as in claim 6 wherein the second multi-rate code generator comprises a pseudo-noise (PN) code generator.

9. A signal code acquisition system as in claim 6 wherein the second transceiver comprises:

a receiver;

a synchronization detector connected to the receiver; and

a second control circuit connected to the synchronization detector, wherein the second multi-rate code generator is connected to the receiver and the control circuit.

10. A signal code acquisition system as in claim 9 wherein the first transceiver comprises:

a transmitter; and

a first control circuit connected to the transmitter, wherein the first multi-rate code generator is connected to the transmitter and the first control circuit.

11. A signal code acquisition system as in claim 6 wherein the first multi-rate code generator comprises a first dual rate code generator.

12. A signal code acquisition system as in claim 11 wherein the second multi-rate code generator comprises a second dual rate code generator.

13. A method of determining a coded signal, the method comprising steps of:

transmitting a first coded signal from a transmitter system;

receiving the first coded signal on a receiver system;

calculating a probability of detection of the first coded signal; and

changing the first coded signal to a second coded signal responsive to the probability of detection (PD) of the first coded signal.

14. A method as in claim 13, wherein the steps of transmitting and receiving the first coded signal comprises the steps of transmitting and receiving a first pseudo-noise (PN) coded signal, respectively.

15. A method as in claim 13, wherein the step of changing the first coded signal to the second coded signal responsive to the PD of the first coded signal comprises

the step of changing to the second coded signal when the PD exceeds about 97%.

16. A method as in claim 15 wherein the step of changing the first coded signal to a second coded signal comprises the steps of:

waiting a predetermined amount of time;

changing a first pseudo-noise (PN) codec of the receiver system to a second PN code after the predetermined amount of time has elapsed; and

changing a second PN codec of the transmitting system to a second PN code after the predetermined amount of time has elapsed.

17. A method as in claim 16 wherein the steps of changing the first and second codecs comprise the steps of changing the first and second codecs contemporaneously.

Fig. 1

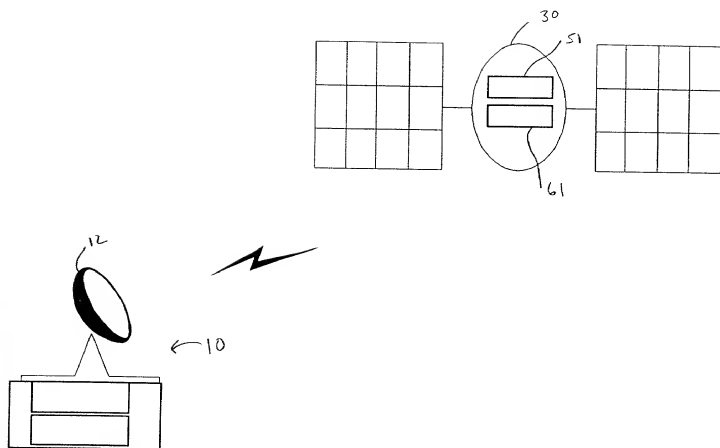
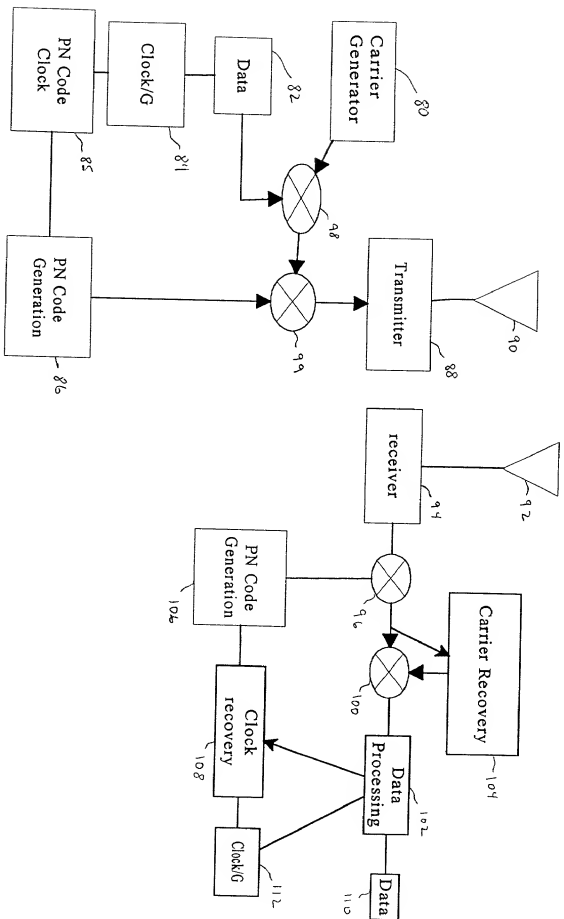
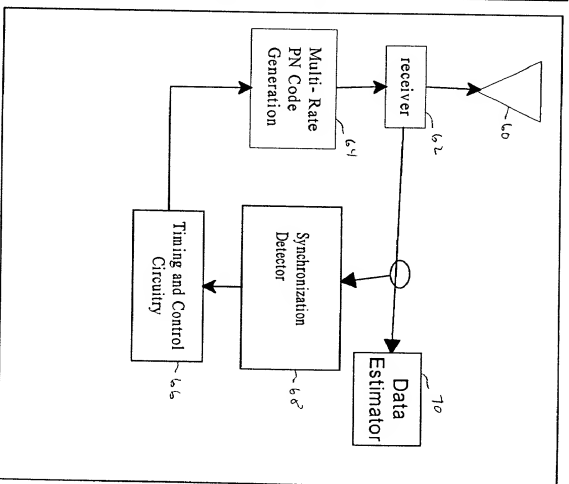
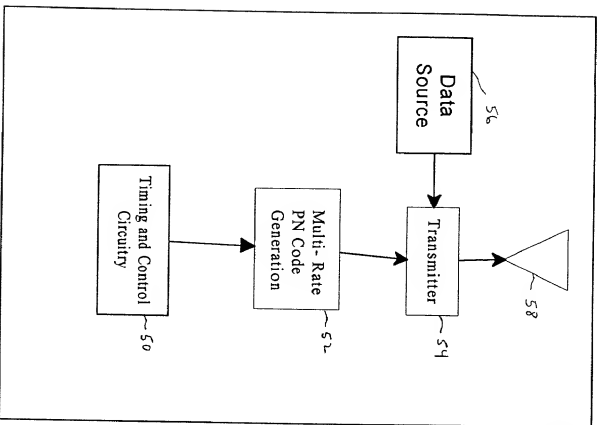


Fig. 2
Prior Art



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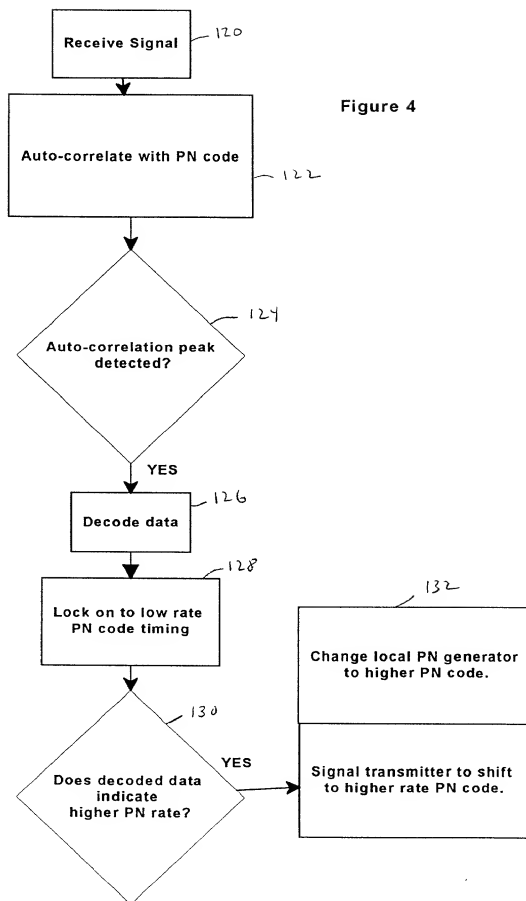
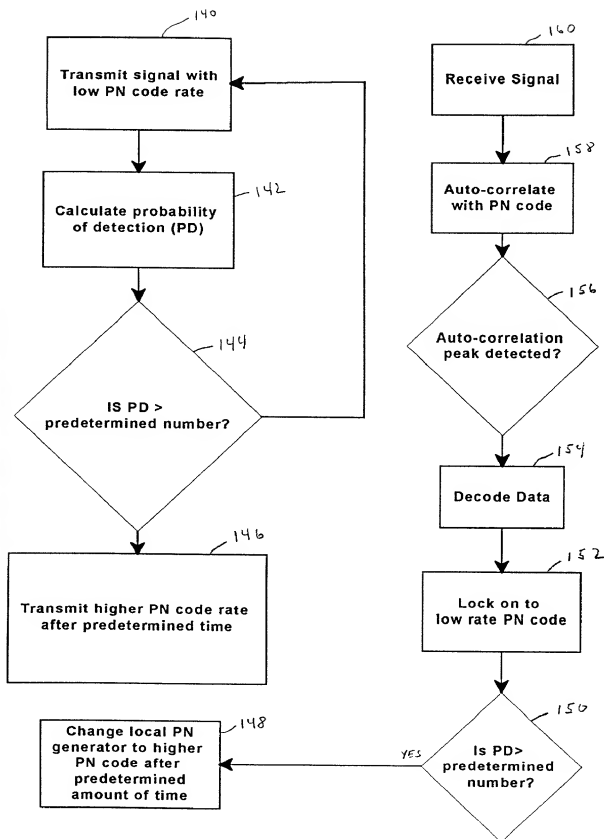


Fig. 5



**ADDED PAGE TO COMBINED DECLARATION AND POWER OF
ATTORNEY FOR SIGNATURE BY FOURTH AND SUBSEQUENT INVENTORS**

Full name of fourth joint inventor, if any

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